APPENDIX J
TREATABILITY SCOPE OF WORK

SCOPE OF SERVICES
FOR THERMAL TREATABILITY STUDY
[_____]

[__] [MONTH] 19[__]

EXAMPLE
LOW TEMPERATURE THERMAL DESORPTION

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1. General.

1.1 General Statement of Services. The U.S. Army Corps of Engineers (USACE), [_____] District, is contracting for services, including analytical support, to execute a treatability study for desorption of HTRW contaminants from the contaminated materials from [_____ (site name)] and to prepare a treatability study report.

1.2 Qualifications.

1.2.1 Laboratory Validation/Certification. [_____ (certification for contaminants of concern)]

1.2.2 Chief Chemist. Qualifications of the chief analytical chemist designated oversee the analytical work shall be included in the work plan submittal. The chief chemist(s) shall have a minimum of six (6) years of experience, including four (4) years of organic chemical analyses.

1.2.3 Bench Chemists and Laboratory Technicians. Qualifications of the chemists designated to work on these tasks shall be included in the work plan submittal.

1.2.4 Quality Assurance Laboratory Validation/Certification. [_____ (certification for contaminants of concern)] shall be included in the work plan submittal

1.2.5 Chemical/Environmental/Process Engineer. Qualifications of the chief engineer designated to oversee these tasks shall be included in the work plan submittal. The engineer shall have a minimum of six (6) years of experience.

1.2.6 Project Manager. This scope will be assigned a project manager (PM), to serve as the single point of contact for submittals, schedules and information regarding the status of the work. Deviations, changes, inadequacies of any kind, and any questions related to compliance with this delivery order shall be immediately reported to [_____], at the [_____] District ([_____] AC) [_____]-[_____] (CE[_____]-[_____]-[_____]).

2. Reference Documents and Publications. Guidance and publications containing pertinent information include the following:

ETL 1110-1-173	Thermal Desorption
EM 385-1-1	Safety and Health Requirements Manual
ER 385-1-92	Safety and Occupational Health Document Requirements for Hazardous, Toxic and

	Radioactive Waste (HTRW) Activities
ER 1110-1-12	Quality Management
ER 1110-1-263	Chemical Data Management for Hazardous Waste Activities

3.0 Information.

3.1 Quality. Quality management shall be in accordance with ER 1110-1-263 and ER 1110-1-12. The AE is responsible for completeness and accuracy of work performed under this scope, and for compliance with all parts of the scope. Comprehensive quality control reviews shall be performed for accuracy, completeness of the work, compliance with the scope and satisfaction of the scope requirements.

3.1.1 Completeness of Work. All deficiencies identified by the quality control review and/or by the Government shall be corrected.

3.1.2 Accuracy of Work. All data shall be verified and all calculations shall be checked in the quality control review. The Inaccuracies and errors identified either by the Government or the quality control review shall be corrected.

3.2 Confidentiality. Documents and information developed or obtained in performance of the work shall be considered privileged information of the United States Government. Information shall not be released to anyone other than the officers, employees and agents who need to have access to the information to perform the work and U.S. Government officers designated by the POC. Requests for release of any of the information shall be referred to the POC for reply. The obligation to maintain the confidentiality of this information shall extend beyond the completion of this scope until released by the POC or determined by a federal court of competent jurisdiction.

3.3 Conflict of Interest. Prior to proposal submission, AE and subcontractor(s) employees with access to the information and documents shall identify any potential conflicts of interest (COI) with the requirements of this scope. Any past or on-going work conducted by, or involving, the Contractor, subcontractor(s), or respective personnel, for the Corps of Engineers, EPA, or other regulatory agencies regarding services required by this scope, may be considered as a COI. If the potential for a conflict exists, the USACE must be notified when it is discovered for a determination of eligibility for award of this scope. A statement on the potential for conflicts must be provided with the initial proposal for this scope.

3.4 Services and Materials. All labor, travel and work described in the scope shall be supplied. All services, supplies, materials, materials, equipment, plants, labors, and travel necessary to perform the work and render the data required under this scope are required to be furnished. Included are laboratory equipment, micro computers, commercial software packages, modems and facsimile (FAX) machines required to perform the work.

4.0 Progress and Payments. Progress reports showing scheduled and actual performance and task completion dates shall accompany each payment request. Each listed task shall be completed and approved prior to commencing work on the next listed task. Final payment on delivery orders will be made after all work is completed in compliance with the delivery order, after all required documentation has been submitted, and after all government audits and reviews have been completed.

5.0 Submittals, Meetings and Travel. Personnel may be required to travel to attend meetings scheduled at the [_____] Offices, [_____ (city)], [_____ (state)], as part of this delivery order. Responsible representatives, approved by USACE for participation in the pilot study, shall attend the indicated meetings. The representatives shall annotate comments and prepare meeting notes for each review meeting. Costs associated with travel shall be separately itemized in the delivery order cost. The AE shall assume, for purposes of negotiation, that two people from the firm will attend each meeting.

5.1 Task 1: Treatability Study Work Plan. The work plan will include an execution plan for development of the treatability study in accordance with the criteria with explanatory text and notes and a detailed outline of the suggested technical requirements for each of the sections. The plan shall identify the equipment and personnel for accomplishing each effort.

5.2 Task 2: Treatability Study Work Plan Review, Coordination, and Meeting Number 1. Appropriate personnel shall attend a review meeting to address various subjects pertaining to the treatability study after receiving USACE comments on the work plan. Comments will be forwarded in advance to allow annotation prior to the meeting. A copy of the annotated comments shall be forwarded along with major points requiring discussion prior to the review meeting. Appropriate personnel shall make a presentation of the plan, the outline, total effort, content and the work accomplished to date. Appropriate personnel shall participate in discussion designed to ensure understanding of the agency goals. The result of this meeting will be further USACE guidance and direction to proceed. Responsible team personnel shall be identified to be approved in this preliminary meeting.

Revisions to the execution plan may be required as a result of this meeting.

5.3 Task 3: Task 3: Sample Collection, Preservation, Transportation, Treatability Study Execution and Draft Report. The study shall be performed and a full draft of the treatability study report shall be prepared, in accordance with guidance and direction received at the initial submittal meeting, which shall be submitted for USACE review and approval.

5.4 Task 4: Draft Review, Coordination, and Meeting Number 2. Appropriate personnel shall attend a review meeting to address various subjects pertaining to the treatability study after receiving USACE comments on the draft report. Comments will be forwarded in advance to allow annotation prior to the meeting. A copy of the annotated comments shall be forwarded along with major points requiring discussion prior to the review meeting. Appropriate personnel shall make a presentation of the report and participate in discussion designed to ensure understanding of the agency goals. Revisions to the report may be required as a result of this meeting. Technical personnel shall participate in discussion with USACE personnel regarding comments and revisions to the draft report. The meeting will result in USACE direction for the AE to complete the final report.

5.5 Task 5: Final Treatability Study Report. The report shall be completed for implementation and record purposes in accordance with this scope of services. The final report will incorporate all approved comments generated by review of previous submittals, any revisions in the format, technical content, grammar or as otherwise required to ensure the documents are in the proper form.

5.6 Schedule.

Scheduled Task	Day of Required Completion
Notice to Proceed	CD [_____]
Task 1: Work Plan	CD [_____]
Task 2: Work Plan Review, Coordination, and Meeting Number 1	CD [_____]
Task 3: Sample Collection, Preservation, Transportation, Treatability Study Execution and Draft Report	CD [_____]

Task 4: Draft Review, Coordination, and Meeting Number 2	CD	[_____]
Task 5: Final Report	CD	[_____]
Total calendar days		[_____]

6.0 Format and Presentations.

6.1. A cover page shall identify the Corps of Engineers, [_____] District, Control Number and the date.

6.2 This statement of work shall be attached to the work plan and draft reports. Submittals shall include incorporation of all previous review comments and the disposition of each comment. Submittals shall be complete and not just copies of affected pages. Disposition of comments submitted with the final submittals shall be separate from the documents.

7. Technical Requirements. (See attached outline)

8. Project Records and File.

8.1 Project File. All memos and records obtained or developed in the performance of this scope shall be assembled with a complete index at the completion of this scope. Records shall be organized using a chronological method with a supplementary topic index. Originals of project records, including the index, shall be placed in secure boxes, marked with the control number and sent to the POC. Copies of any of the correspondence and records shall not be retained without written permission from USACE.

8.2 Meeting Notes. Notes and reports for meetings shall be prepared in typed form and the original furnished tothe POC (within ten working days after the date of the meeting) for concurrence and distribution.

Meeting reports shall include the following items as a minimum:

- Project name and control number.
- Date and location of the meeting.
- Attendance list including each name, organization, telephone and FAX numbers.
- Written comments with the action noted shall be attached to each copy of the report. Action shall be "A" for an approved comment, "D" for a disapproved

comment, "W" for a comment that has been withdrawn by the government with the approval of the commenter, and "E" for a comment that has an exception noted.

- Discussion items.

8.3 Record Memos. A record or file memo of each contact, meeting, conference, discussion, telephone conversation, or verbal directive regarding the subject documents irrespective of who the other participants may have been will be prepared. Records and memos shall be dated and shall identify participating personnel, subjects discussed and conclusions reached. Memos shall be numbered sequentially and shall be incorporated in the project file. Any distribution of these memos shall be made by the Government.

8.4 Correspondence. A record of each piece of written correspondence related to the performance of this Delivery Order shall be kept. The pieces of correspondence shall be numbered sequentially and shall be incorporated in the project file as described in paragraph 8.1. Any distribution of said correspondence shall be made by the Government.

8.5 Issues. Issues requiring Corps action or response and issues regarding the schedule shall be highlighted by a letter to the POC.

9. Document Distribution. Unless otherwise directed, submittals and review material shall be submitted to the following addresses:

Number of Copies	Item	Addressee
[_____]	Memos	Commander
	Work	U.S. Army Engineer District, [_____]
	Plan	ATTN: [_____]
	Draft	[_____] [_____] [_____]
	Final	[_____ (City)], [_____ (St)] [_____]-[_____]
[_____]	Memos	Commander
	Work	U.S. Army Engineer District, [_____]
	Plan	ATTN: [_____]
	Draft	[_____] [_____] [_____]
	Final	[_____ (City)], [_____ (St)] [_____]-[_____]

(Enclosure 12 ETL 1110-1-154)

10. Treatability Studies And Treatability Studies Reports

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Treatability studies are performed as necessary and appropriate for the waste materials and evaluation of treatment options. If any treatability studies are performed, the report should be completed and submitted, even if the recommendation is not to use the process. Contracting for treatability studies is difficult and inappropriate before the contaminants and contaminated media are identified and quantified. It is a good idea to include an option for treatability studies in most predesign scopes. Treatability studies are not always required.

See the EPA "Guidance for Conducting Treatability Studies Under CERCLA," EPA/540/R-92/071a October 1992 for general guidelines.

The process engineer (either an environmental engineer with process design experience or a chemical engineer with design experience), the geologist (if the treatability study would be testing the withdrawal of ground water or soil vapor), the geotechnical engineer (if the contaminated media is soil), and the chemist need to be involved in development of the scope of any treatability study.
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1. Identifying Sources for Results of Previous Treatability Studies on Similar Materials

1.1 Literature Search/Expert Judgment

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Reports and Documents
Guidance for Conducting Remedial Investigations and Feasibility Studies
Superfund Treatability Clearinghouse Abstracts
The Superfund Innovative Technology Evaluation Program: Technology Profiles
Summary of Treatment Technology Effectiveness for Contaminated Soil
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1.2 Electronic Data Bases

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Alternative Treatment Technology Information Center (ATTIC)

Computerized On-Line Information System (COLIS)
OSWER Electronic Bulletin Board System (BBS)
RREL Treatability Data Base
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1.3 EPA Personnel Consultations through EPA RPM

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Robert S. Kerr Environmental Research Laboratory Ground-Water Fate and Transport Technical Support Center Ada, OK
Risk Reduction Engineering Laboratory Engineering Technical Support Center Cincinnati, OH
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2. Treatability Study Work Plan Outline

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The treatability study Work Plan should be submitted and approved before initiation of the sampling for treatability studies. Chemists, geologists, geotechnical engineers, industrial hygienists, process design engineers, and regulatory personnel should review the Work Plan for a treatability study. This plan would be considered an attachment to the project Work Plan and would not, to the extent practical, reiterate information presented in the project Work Plan.
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2.1 Background
2.1.1 Project Description

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This should be presented in the project Work Plan unless the treatability study is scoped separately.
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2.1.2 Remedial Technology Description and Process Flow Diagrams

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Consider the consequences if the sequence of unit process is rearranged. Consider the ultimate disposal requirements of

all phases and all side streams. Cross media transfer without neutralization of the toxicity is discouraged by the National Contingency Plan.

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2.1.3 Previous Results with Similar Influent Materials

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List references and describe the limitations of similarity.
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2.2 Treatability Test Objectives

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Refer to section 1 of the RI/FS outline for the appropriate approach to determining objectives. Also refer to section 2.1 of the RI/FS for information on scoping Contractor involvement in developing objectives. See Enclosure 11, Alternative Development and Selection.
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2.2.1 Remedy Screening - Qualitative
2.2.2 Remedy Selection - Quantitative
2.2.3 Establishing Data Quality Objectives (DQOs)-
Precision, Accuracy, Representativeness,
Completeness, and Comparability (PARCC)
2.3 Approach
2.4 Reporting Requirements
2.5 Schedule and Level of Effort
2.5.1 Schedule

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The draft treatability study should be submitted for review and comment before disassembly of the equipment. Bench scale tests should be performed before the ROD is prepared.

Bench scale test: laboratory validation of treatment processes. Tests are normally batch or equilibrium adaptations of the steady state processes. Tests may be performed on actual or simulated waste material. Spiking of actual waste or simulation is frequently necessary to test for worst conditions.

Screening tests should be performed early in the alternative development process. There are some new, quick and inexpensive, methods and facilities available for preliminary screening at EPA RREL in Cincinnati. If these EPA facilities are considered, RREL may have an SOP that is adequate for the scope. Ask for a copy and review it to see if it meets the needs of the project.

Other batch tests should be performed after the site has been

characterized, late in the RI or early in the FS, for appropriate sample selection.

Analyses for interferences are easily performed in the batch mode. Most divalent metal ions interfere with continuous operation of oxidation processes and air stripping. Accuracy of plus or minus 0.05 ppm is appropriate for the prevalent cations and hardness.

Pilot tests are demonstration tests that simulate a process closely enough to determine design parameters for full scale unit operations. A pilot test is normally conducted on actual waste material, although some spiking is used to determine capacity or to simulate worst anticipated field conditions. Pilot tests often attempt to simulate worst conditions. Pilot studies may be performed to determine equipment capacity and range of operation parameters (i.e. concentration, temperature, contact, residence, or detention time) required to obtain the performance objectives.
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2.5.2 Level of Effort

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Remedy screening
Study scale: bench
Data generated: qualitative
Process type: batch
Waste stream volume: small
Number of replicates: single/duplicate
Time required: days
Cost range: $10,000-$50,000
Remedy selection
Study scale: bench-full
Data generated: quantitative
Process type: batch or continuous
Waste stream volume: medium to large
Number of replicates: duplicate/triplicate
Time required: days/months
Cost range: $50,000-$250,000
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2.5.3 Budget
2.6 Experimental Design and Procedures

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Treatability studies should be designed to obtain the data that is needed to assess the effectiveness of a specific process in remediation.

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2.6.1 Experimental Design
2.6.2 Detailed Outline of the Procedures

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The treatability study Work Plan should include step-by-step detail of the procedures to be used in performing the treatability study.
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2.6.2.1 Methods
2.6.2.2 Procedures
2.6.2.3 Sample Material Handling
2.6.2.4 Treated Material Handling
2.6.2.5 Process Residuals Handling
2.7 Equipment and Materials

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Equipment and instrumentation to be used in the treatability study should be completely identified.
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2.7.1 Equipment
2.7.2 On-line Monitors
2.7.3 Other Instrumentation

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Field type instrumentation is satisfactory for most pilot scale work with full laboratory data quality management implemented only on selected samples before and after treatment. The Work Plan should indicate the instrumentation to be used.

Measure parameters that affect field implementation; ultimate disposal; mechanical stability of residual solids; effects of freeze thaw cycles; dust generation; water absorption or loss pH and pH changes; temperature and temperature changes; heat loss; heat gain.

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2.8 Chemical Data Acquisition Plan/Sampling and Analysis Plan (SAP)

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This does not replace the RI/FS sampling requirements, it merely cites special considerations for treatability studies. This plan will essentially incorporate the elements of the EPA's Field Sampling Plan, Quality Assurance Project Plan, and Data Management Plan. Depending on the nature of the field activities needed for the treatability study, a Monitoring Well Installation and Drilling Plan may be required.

The handling of gross samples should be as similar as possible to the handling of the analytical samples. See Enclosure 13: Chemistry Technical Requirements.

As an option, the sample collection section and the sample analysis and validation sections can be broken out as separate tasks. Given the limited nature of the sampling in many studies and the important role chemical analysis may have in treatability studies, they are discussed under the treatability study task.

The chemist should consult with the process engineer to determine what analytical parameters are to be monitored during the treatment process. Analytical levels II, III, IV, or V may apply to these studies. Data reporting format and turnaround time may need to be specified in this section, depending upon users needs.

Field samples may not represent the predicted worst case. Analyze portions of the samples before shipment to the treatability study laboratory. At a minimum, treatability testing should be performed under worst case conditions and under typical or average conditions. It may be necessary to provide supplemental contaminants.

Volume estimates on the amount to be treated should be provided or a cross reference to the appropriate part of the treatability study plan be provided.

Field sample waste streams for characterization and testing, conduct treatability tests, analyze samples of treated materials and residuals

The SOW should have the Contractor estimate the projected volume of material to be treated to determine equipment capacity.

For appropriate sample selection, pilot tests should be performed after overall site characterization (QA/QC documentation need not be complete), concurrent with alternative selection and ROD development, before initiation of design.

Final Treatability Study Reports may be submitted concurrently with the RI/FS or separately.

For Quality Assurance issues, coordinate with and refer to the project Work Plan quality assurance section. Quality assurance needed for remedy screening is the least stringent; for remedy selection, moderately stringent QA is appropriate.

For data analysis and data interpretation, see Enclosure 11: Alternative Development and Selection for a discussion of alternatives.
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2.9 Site Safety and Health Plan/ Health and Safety Plan

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The site safety and health plan for the RI characterization activities may cover all of the types of activities required. Append new procedures to the existing plan.
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2.10 Residuals Management and Compliance with the Regulatory Requirements
2.10.1 Residuals Management
2.10.1.1 On Site
2.10.1.2 Off Site
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The regulatory specialist must confirm that off-site lab facility to run treatability tests is permitted or plans to operate under the RCRA treatability exclusions in 40 CFR 261.4 (e) and (f). If the treatability exclusion is to be used, state regulations must be considered and the CFR must be carefully read to minimize adverse impacts on the project. Some impacts can be handled through scoping.
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2.11 Community Relations

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The community relations plan for the pilot study must be in concert with the project community relations plan.
Remedy screening: low profile/few activities
Remedy selection off site: generally not controversial and low profile/few activities

An on site remedy selection may be controversial and high profile/significant activities.

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2.12 Management and Staffing
2.13 Outline for the Treatability Study Report

3. Treatability Study Report Format Outline
3.1 Introduction
3.1.1 Site Description
3.1.2 Waste Stream Description
3.1.3 Treatment Technology Description
3.1.4 Previous Treatability Studies at the Site
3.2 Conclusions and Recommendations
3.2.1 Conclusions
3.2.2 Recommendations
3.3 Treatability Study Approach
3.3.1 Test Objectives and Rationale
3.3.2 Experimental Design and Procedures
3.3.2.1 Design
3.3.2.2 Procedures
3.3.2.3 Discussion of any Variations from the Work Plan
3.3.3 Equipment and Materials
3.3.4 Sampling and Analysis
3.3.4.1 Analyses or Reference to the Appropriate Report
3.3.4.2 QA/QC Report or Reference to the Appropriate Report
3.3.5 Data Management
3.3.6 Derivatives from the Work Plan
3.4 Results and Discussion
3.4.1 Data Analysis and Interpretation
3.4.2 Quality Assurance/Quality Control
3.4.3 Identification of Additional Testing Needs
3.4.4 Cost/Schedules for Performing the Treatability Study
3.4.5 Key Contacts

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All Superfund/NPL treatability reports are submitted to the RREL Treatability Data Base Repository, organized by the EPA Office of Research and Development.
Attn: Mr. Glenn Schaul
RREL Treatability Data Base
U.S. EPA ORD Risk Reduction Engineering Laboratory
26 West Martin Luther King Drive
Cincinnati, OH 45268
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3.4.6 References
3.4.7 Standard Operating Procedures
3.4.8 Data Summaries
3.4.9 All Side Notations from Laboratory Books

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These notes may have significant value.
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4. Appendices to the Treatability Study
4.1 Sample Calculations Showing
4.1.1 Use of generated Data
4.1.2 Identification of all Variables
4.1.2.1 Measured
4.1.2.1.1 Range of Experimentally Determined Values for the Variables.
4.1.2.1.2 Sensitivity to Variation
4.1.2.2 Calculated
4.1.2.3 Assumed
4.1.2.2 Unknown
4.2 Process Flow Diagrams
4.2.1 Flow Diagram
4.2.2 Material Balance Showing Average Values
4.3 Summary of the Data
4.4 Scale-up Considerations
4.4.1 Performance
4.4.2 Operation and Maintenance
4.5 Identification of the Limits of the Process as Indicated by the Results

5. Specific Process Recommendations
5.6 Thermal Desorption/Incineration

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CEWES has a low temperature pilot unit and will perform treatability studies. Obtain a copy of the WES protocol to get an understanding of how they will do the study and what the report will be like. The Contractor and the design district process engineer both need to understand what WES will do and if the information will be adequate for design. If there are any Contractor requested changes to the WES protocol the district process engineer should be involved in the changes.

"Guide for Conducting Treatability Studies under CERCLA: Thermal Desorption Remedy Selection" is being prepared by EPA contract.

Obtain an adequate and representative sample. The Contractor should be responsible for sample collection, packaging and shipping to WES if WES does the study.

Characterize/analyze a sample of the sample prior to shipment. Consider parameters that affect VOC removal rates:

Undisturbed moisture content of sample
BTU content of sample
Temperature
Air and/or oxygen flow
Residence time
Time and temperature curves
Consider problems
Slag formation

Partitioning of the metals: Keep track of where the metal are. Materials handling: Soil characterization including liquid limit, plastic limit, etc.

If the feed material contains significant amounts of heavy metals, produce enough ash for solidification/stabilization tests while the thermal treatment test is going. Provide adequate material for the unit to achieve steady state before measurements are made to determine the operating parameters. Enough samples to represent the entire site should be processed.
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